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Cognitive and Emotional Changes in Peer Educators of Type 2 Diabetes Patients After Starting Peer-Support Activities

Haruka Aoto,* Nobuyuki Kobayashi,† Yasuko Tokushima,* Chika Tanimura,* Mika Fukada,* Abir Nagata,‡ Shinji Otani,§ Tetsuji Morita,‖ Kazuoki Inoue,¶ Keiichi Hanaki,* Seiji Kageyama, and Youichi Kurozawa††**

**School of Health Science, Faculty of Medicine, Tottori University, Yonago 683-8503, Japan, †Arid Land Research Center, Tottori University, Tottori 680-0001, Japan, ‡Department of Regenerative Dermatology, Graduate School of Medicine, Osaka University, Osaka 565-0871, Japan, §International Platform for Dryland Research and Education, Tottori University, Tottori 680-0001, Japan, ‖Department of Rehabilitation, Daisen Rehabilitation Hospital, Hoki-cho 689-4102, Japan, ¶National Health Insurance Daisen Clinic, Daisen-cho 689-3314, Japan, **Division of Virology, Faculty of Medicine, Tottori University, Yonago 683-8503, Japan, and ††Division of Health Administration and Promotion, Faculty of Medicine, Tottori University, Yonago 683-8503, Japan*

ABSTRACT

Background Diabetes self-management education through peer support has beneficial effects, especially in regions with limited medical resources. To ensure peer educators continue to provide peer-led education programs, it is important that they remain motivated to instruct patients. Here, to explore measures to enhance peer-educators' motivation toward such programs, we examined the cognitive and emotional changes in Filipino type 2 diabetics after 7-month activities as peer educators.

Methods We individually performed semi-structured interviews with 13 peer educators with 20 years of age or above in August 2017 (immediately before starting their peer-education activities) and in March 2018 (7 months after the start). The first interview was performed after the peer educators had received 2-day training of diabetes self-management. In both interviews, we asked the peer educators about their feelings toward peer-led educational activities (e.g., satisfaction, difficulty, reward, confidence, and challenges). Their replies about their own cognition and emotions were interpreted and integrated, and then analyzed qualitatively.

Results Four and seven categories were extracted from the first and second interviews, respectively. The category "Cognition of patients' active learning attitudes and of positive changes in patients' physical conditions and behavior" observed in the second interview led to "Cognition of growth as a peer educator" and "Satisfaction with supporting patients as a peer educator." These two feelings gave the peer educators' "Increased motivation to continue the activities as a peer educator." This motivation was also associated with "Active collaboration among peer educators," which was affected by "Difficulties and concerns in working as a peer educator."

Conclusion To sustain diabetic peer-led education programs, we suggest that interventions be implemented that increase peer educators' motivation toward their activities and stimulate their awareness of the importance of collaborating with one another. Such collaboration should help to overcome the difficulties they may face in providing peer-led education.

Key words patient education; peer group; Philippines; qualitative research; type 2 diabetes mellitus

According to the International Diabetes Federation, 537 million people worldwide were suffering from diabetes in 2021.[1] Type 2 diabetes (T2D) is now a global health issue. Improvement of diabetes-related indicators in T2D patients is important for maintaining their quality of life. Diabetes self-management education (DSME) offered to T2D patients is reported to comprehensively improve these indicators. Indeed, positive effects of DSME on patients' diabetes knowledge, frequency and accuracy of self-monitoring of blood glucose, self-reported dietary habits, and self-initiated glycemic control have been reported from a systematic review of 72 randomized control trials (RCTs).[2] Improvement of glycohemoglobin levels (proportional to hemoglobin A1c [HbA1c]) by 0.76% in DSME-recipient groups has been reported from a meta-analysis of 31 RCTs.[3] A systematic review of 12 RCTs has also reported that DSME education can reduce HbA1c levels by 0.21% in T2D patients within 12 months of diagnosis. However, in these studies, the DSME was provided mostly by health professionals.[4]

The positive effects of DSME have been shown to

Corresponding author: Haruka Aoto, PhD
ao.haru0507@gmail.com
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Abbreviations: ARCS, Attention, Relevance, Confidence, and Satisfaction; DSME, diabetes self-management education; RCT, randomized control trial; T2D, type 2 diabetes; TTM, Transtheoretical Model

increase further when it is offered by the peers of diabetics than by health professionals. Tang *et al.*[5] reported the continued effectiveness of DSME programs by peer leaders on diabetics' glycemic control and systolic blood pressure at 18 months after the start of their participation in an education program; such effectiveness was not seen from similar programs offered by community health workers. Furthermore, peer-led DSME programs for diabetics show beneficial effects particularly in areas where medical resources are limited, because they are relatively cheap to deliver compared with those offered by healthcare professionals.[6] Indeed, a meta-analysis of the association of T2D incidence with income level has shown a higher risk of T2D in the poor (i.e., 1.40 times higher than in the rich, with 1.04 to 1.88 times in the 95% confidence interval),[7] indicating the importance of peer-led DSME in areas with limited medical resources. One such area with limited medical resources is the Philippines. The Universal Health Coverage Index of the Philippines in 2017 (61) was still under both the average global value (66) and the average value of the countries in the Western Pacific region (77), where the Philippines is located.[8] In addition, the number of T2D patients in the country is increasing because of an increase in obesity accompanied by rapid urbanization and dietary changes, such that health services are currently unable to accommodate all patients with diabetes.[9, 10] Therefore, greater implementation of DSME in the Philippines could be expected to have a marked impact on the diabetic community in the country.[11]

Peer educators engaged in peer-led DSME programs are volunteers (i.e., not health professionals) and are not financially motivated. Therefore, to ensure that peer educators continue to run such programs for diabetes patients, it is important that they receive continuous motivation and have the confidence (i.e., a belief in their own abilities) to run them.[12] In a quantitative analysis, Tanimura *et al.*[13] measured the motivation and confidence of Filipino peer educators via the responses given to two multiple-choice questions, each of which had 10 answers, about the "value of educating other patients" and "confidence in educating other patients about diabetes"; however, they found that the scores of these two indicators did not change significantly during the 18 months after the peer educators received a 2-day training course. Yonekura[14] used two 4-point scales about the "value of peer support for patients" and "peer-educators' own growth through peer support" to evaluate the motivation and confidence of peer educators who were supporting Japanese patients with chronic diseases; the validity of the satisfaction scale that they developed, which included the two 4-point scales, was confirmed.

Because the motivation and confidence of peer educators who educate patients arise from human emotions, it is important to understand these two characteristics in terms of emotional and cognitive changes. However, tiny changes in complex emotions and cognition in humans cannot be explored comprehensively through quantitative evaluations, which are composed mainly of analyses of measured indicators.[15] Therefore, exploration by using qualitative information, rather than quantitative data, is desirable. Analysis of the changes in peer-educators' own cognition and emotions as they educate patients (i.e., qualitative information) would clarify the factors that improve or hinder the peer-educators' motivation and confidence. Furthermore, on the basis of such an analysis, measures to enhance the sustainability of peer-led education programs could be discussed. Nevertheless, to our knowledge no reports have addressed the changes in peer-educators' cognition and emotions when they act as educators for other patients.

Here, we examined the changes in peer-educators' cognition and emotions in an inductive and qualitative manner by using records of peer-educator interviews performed immediately before, and 7 months after, the peer educators started DSME of patients in an urban poor municipality in the Philippines. We gained insights into useful measures for enhancing the sustainability of peer-led education programs.

MATERIALS AND METHODS

Study design

We analyzed, in an inductive manner, the qualitative data obtained through two interviews with each of 13 peer educators of diabetes patients, in August 2017 (immediately before they started their peer-education activities) and in March 2018 (7 months after the start). The interviews were performed in a diabetes clinic in a municipality of Metro Manila, Philippines (area, 1.76 km^2; total population, about 67,000).

The peer educators were selected from among residents of the municipality with type 2 diabetes who were older than 20 years. Diabetes patients with the following conditions were excluded: pregnancy, dementia, cognitive impairment, mental illness, musculoskeletal disease, cardiovascular disorders, or hospitalization for complications associated with diabetes. These peer educators were selected through discussions between the physician (diabetologist) in the diabetes clinic and members of the Diabetes Association (a non-governmental organization composed mostly of diabetics) in the municipality, both of whom were familiar with the

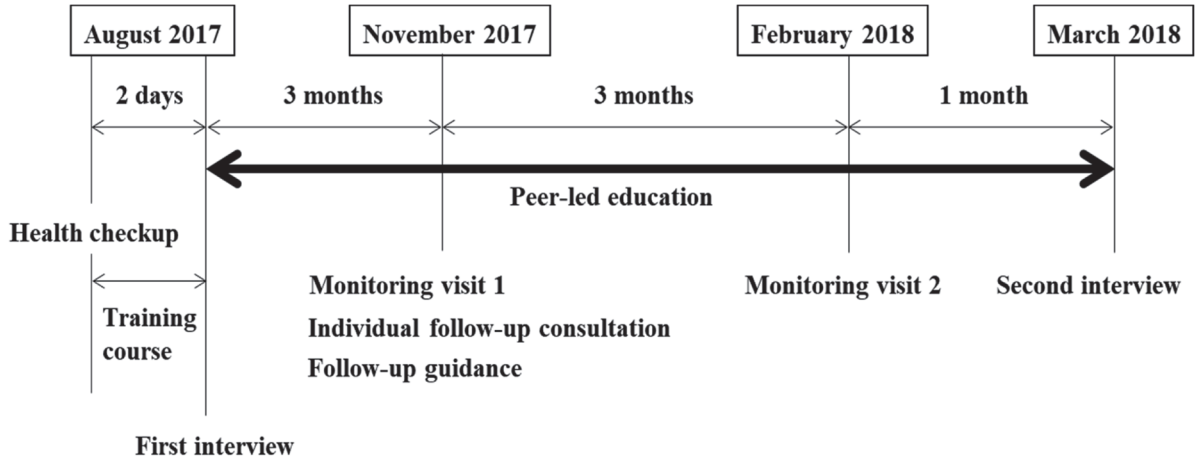

Fig. 1. Schedule of the study.

health conditions and social backgrounds of the diabetic residents.

The study was performed according to the schedule shown in Fig. 1. Immediately before the first interview (August 2017), the peer educators received a health checkup to determine the status of their own diabetes, as well as a 2-day training course on DSME that we provided with the support of health professionals in the municipality.[13] We informed the peer educators of the results of their checkups in individual follow-up consultations in November 2017. The training was based on previously reported DSME[16] and the ARCS model, which includes the four factors that promote and sustain motivation during learning, namely, attention (interest), relevance, confidence, and satisfaction.[17] The training modules were designed to encourage a greater understanding of these factors among the peer educators. For example, the module titled "Healthy eating" included a buffet lunch to help them become interested in their own dietary choices. The quizzes and lectures in the module titled "What is diabetes?" were designed to help them recognize the relevance of the information that the peer educators were presented. The module titled "Building goals and action plans" encouraged the peer educators to plan their education activities so that they were confident in their ability to support other diabetics.[13] The instructional style applied in the training was based on the factors suggested by Bandura[18] that strengthen one's self-efficacy; that is, the training course included activities through which the participating peer educators could experience their own successes and learn from others' successes. The training course also included modules titled "What is the role of a peer educator?" and "Building therapeutic communication," which were included to improve the peer-educators' capacity to educate the patients.[13] These modules pertained to the requirements of a good peer educator, as well as to the need to practice to help promote patients' motivation and behavioral changes. We also prepared a Diabetes Textbook and a Patient Instruction Manual in the Tagalog language for the course. The course comprised hands-on learning, demonstrations, quizzes, role-playing, group sharing, physical exercise, and a buffet lunch to reduce the social and psychological distances among participants.[13]

The peer educators started their DSME activities in August 2017 after the 2 days of training. Although each of the 13 peer educators initially selected more than 5 patients to be provided with DSME, only 40 patients submitted signed informed consent to participate in the study; therefore, each peer educator was responsible for 3 or 4 patients. Each peer educator planned their own activities; we encouraged them to plan the activities by using the knowledge and experience gained in the 2-day training course. They organized group or individual meetings with the patients for which they were responsible when the patients attended checkups at the diabetes clinic. The knowledge and guidance offered to the patients during the meetings were based mostly on the 2-day training course. The peer educators also shared their own experiences in managing their own disease with the patients. These activities usually took about 30 min each. Although the number of meetings or hours offered to each of the 40 patients was not counted, the records of weekly medical checkups in the diabetes clinic confirmed that each of the patients had attended a meeting at least once a month. Therefore, we estimated that all of the patients had received peer-led education at

least 6 times between our two interviews.

The peer-educators' activities were regularly monitored by the physician (diabetologist) in the diabetes clinic and by two visits that we made, in November 2017 and February 2018. In response to the challenges mentioned by the peer educators regarding education for patients, we offered the peer educators follow-up guidance in November 2017 on skills in instructing patients in diabetes self-management, enhancing the patients' motivation, and smoothly performing the activities introduced in the 2-day training course. In this follow-up guidance, a lecture about diabetic complications and prognosis was offered to encourage the peer educators to gain awareness of their own health problems and to identify common health issues among diabetic patients in the municipality.

Data collection and analysis

Each of the two structured interviews for the peer educators included questions about their satisfaction, difficulty, burden, reward, confidence, and challenges. In the interviews, the peer educators were encouraged to provide their honest feelings regarding the educational activities for patients. The duration of each interview was 20 to 30 min per person. The results of the interviews of all 13 peer educators were used in the analysis. Expressions of their cognition and emotions, and changes in cognition or emotions, were selected. Each of the expressions was interpreted and divided into portions. One portion included a single implication, which we labeled an "excerpted expression." Excerpted expressions with similar implications were integrated with abstraction into a code, and likewise, the codes were integrated into a category. Then, all the authors of the study discussed the full results of the analysis to enhance the results' trustworthiness.

Ethical considerations

The study was approved by the ethics committee of the Faculty of Medicine, Tottori University, Tottori, Japan (no. 21A166).

RESULTS

The 13 peer educators comprised 2 males and 11 females. There were 7 individuals in their 60s, and 6 in their 70s (mean, 70.3 years; range, 62–78 years). At the health checkup before the first interview, the peer-educators' mean HbA1c level (%) was 7.41 (standard deviation, 0.77). Reported durations of diabetes were less than 1 year (1 respondent), 1–5 years (3), 6–10 years (3), more than 16 years (4), and unknown (2). Self-reported complications were renal disorder (2), neuropathy (1), and eye disorder (5). The peer-educators' excerpted expressions in the first interview were integrated into 6 codes, which were then further integrated into 4 categories (Table 1). The expressions in the second interview were integrated into 17 codes, and then into 7 categories (Table 2). Here, { }, [ ], and < > denote the category, the code, and the excerpted expressions, respectively. The 11 categories derived from the 2 interviews and their implications are described in the following sections.

First interview (before the start of peer-education activities; Table 1)

{Cognition of the effects of learning about diabetes self-management}: the peer educator feels that they have gained knowledge about diabetes. {Satisfaction with reduction of the peer-educator's own distress regarding diabetes}: the peer educator is satisfied with the mitigation of their distress by gaining knowledge about diabetes. {Lack of a sense of risk from the diabetes because of inadequacy of the peer-educator's basic knowledge of the disease}: the peer educator does not notice the threat and risks of being diabetic because he/she will not feel any symptoms until the disease has progressed to a certain extent. {Need for external support to continue diabetes-related activities}: the peer educator needs to have a firm grasp of diabetes-related knowledge for their education activities, and to control the patients' health conditions through regular health checkups and through guidance on physical exercise and a healthy diet, all of which are offered by health professionals.

Second interview (7 months after the start of peer-education activities; Table 2)

{Cognition of patients' active learning attitudes and of positive changes in patients' physical conditions and behavior}: the peer educator recognizes that the patients are eager to learn about diabetes and that the patients' behavior and diabetes-related values have improved after their being offered guidance on physical exercise and a healthy diet. {Cognition of growth as a peer educator}: the peer educator recognizes that he/she has gained a lot of knowledge and skills to communicate with patients by teaching them, and that he/she has grown as a peer educator. {Satisfaction with supporting patients as a peer educator}: the peer educator feels satisfied with his/her ability to support patients by offering them guidance as a peer educator. {Increased motivation to continue the activities as a peer educator}: the peer educator wants to continue the peer-led education activities. {Active collaboration among peer educators}: peer educators collaborate to work together and share how they educate the patients and what they teach them. {Difficulties and

Table 1. Cognition and emotions of peer educators, as observed before they started their peer-education activities (August 2017)

Category	Code	Peer-educator's excerpted expression
Cognition of the effects of learning about diabetes self-management	Appreciation of the opportunity to learn methods related to diabetes management.	I was able to learn a lot about how to manage our diseases.
	Sense of the significance of gaining knowledge about diabetes	It means a lot that our knowledge levels have increased.
		The training offered me knowledge about how to maximize the effects of diabetes self-management, and of proper diet, physical exercise, and medications.
Satisfaction with reduction of the peer-educator's own distress regarding diabetes	Satisfaction with reduction of the peer-educator's own distress regarding diabetes	I felt better after learning about why/how I get distressed about being diabetic.
Lack of a sense of risk from the diabetes because of inadequacy of the peer-educator's basic knowledge of the disease	Lack of a sense of threat from the diabetes because of insufficiency of the peer-educator's basic knowledge of the disease	I lack basic knowledge. I don't feel a sense of threat because I'm not aware of the seriousness of, or threat posed by, the diabetes.
Need for external support to continue diabetes-related activities	Peer-educators need external support for their education activities	Continuous support for the peer-educators' activities is needed.
		I hope somebody will give us support related to diabetes.
	Peer-educators need external support for other patients	We need your help in providing medical help.
		There is a need to continue medical checkups.
		I hope another seminar will be held to support patients with diabetes and improve their knowledge.

concerns in working as a peer educator}: when the peer educator tries to continue the peer-led education, he/she faces difficulties in encouraging patients to participate in DSME; for example, the peer educator may have trouble with patients' being unavailable and is therefore concerned about whether or not he/she will be able to offer proper patient guidance. {Need for continuous intellectual, technical, and material support regarding diabetes}: the peer educator needs medical services, continuous technical support for their education activities, and in-kind support for dealing with the patients' diabetes, as well as his/her own.

DISCUSSION

In the first interview, the peer-educators' cognition and emotions that were to be compared with those in the second interview were delineated. Before receiving the training on DSME, the peer educators had had few opportunities to gain knowledge about diabetes. The category of {Cognition of the effects of learning about diabetes self-management} indicated the effects the training had on them. Through the training, they were able to gain greater cognition of two of the four factors of the ARCS model[17]: attention (cognition of an interest in what is being taught) and relevance (cognition that the content offered in the training is related to their needs). Their excerpted expressions of <It means a lot that our knowledge levels have increased> and <The training offered me knowledge about how to maximize the effects of diabetes self-management, and of proper diet, physical exercise, and medications> (Table 1) indicated their recognition that the knowledge they gained and the lectures they received were relevant to solving their own problems. The training was arranged in accordance with the participants' culture and circumstances.[13] Previous studies have reported that education programs arranged in this way pique the interest of learners.[19, 20] Therefore, it was plausible that the training piqued the peer-educators' interest in better self-management of their diabetes.

Chuman and Doi have reported that the distress experienced by T2D patients became lower as they gained knowledge about the disease.[21] Moreover, the ARCS model stresses the importance of inducing learners' satisfaction (i.e., cognition that they understand the usefulness of acquired knowledge).[17] The second category of {Satisfaction with reduction of the peer-educators' own distress regarding diabetes} indicates that their distress was reduced by their obtaining knowledge about diabetes, as well by their gaining an appreciation of the usefulness of this knowledge, leading to their feeling satisfied; enhancement of this component of the ARCS

Table 2. Cognition and emotions of peer educators, as observed 7 months after they started their peer-education activities (March 2018)

Category	Code	Peer-educator's excerpted expression
Cognition of patients' active learning attitudes and of positive changes in patients' physical conditions and behavior	Cognition of patients' positive changes that are caused by the peer-educators' actions	There were improvements in the patients' blood-glucose levels as a result of introducing them to a proper diet and physical exercise as part of our activities.
		The patients acquired new knowledge.
		Our education of patients by using an empathic attitude helped reduce the patients' sense of burden.
		The pleasant and fun experiences we offered to patients improved their self-efficacy and behaviors toward diabetes self-management.
		The patients' awareness of the benefits of diabetes self-management increased through the peer-educators' continuous efforts to remind patients of the threat of diabetes.
		The activities planned and implemented by the peer educators created uplifting feelings and evoked emotions in the patients.
	Cognition of patients' attitudes in actively learning about diabetes	The patients listened intently and tried to learn all they could from the peer-educators' activities.
		The patients are very eager to know about the important approaches useful for treating diabetes.
Cognition of growth as a peer educator	Acquisition of knowledge and skills in working as a peer educator	I was able to obtain new information.
		I learned many skills through the training.
		Educating patients is a good opportunity also for us to improve our memory and skills as peer educators.
		I acquired new knowledge and experience.
	Acquisition of confidence in educating patients as a peer educator	I have the confidence to lead activities as a peer educator.
		I feel that I was able to educate the patients to the greatest extent possible.
		I feel confident because, before I started giving guidance to the patients, I received instruction from medical/educational experts on how to run peer-education activities.
		The knowledge I learned in the meeting in which we studied each other as peer educators has become part of my daily life, so it is easy to pass on that knowledge to other patients.
		I realized that I can lead the patients well.
		I think that we have acquired appropriate techniques to properly perform medical check-ups and guidance for patients.
		Being able to provide guidance for patients who are in the same situation as the peer educators gave me the confidence to serve as a peer educator.
	Improvement in the peer-educator's ability to communicate as a peer educator	I was able to share with other patients what I learned through the training and through my colleagues' activities as peer educators.
		I also learned how to interact with other patients through the training and through my colleagues' activities as peer educators.
Satisfaction with supporting patients as a peer educator	Satisfaction with supporting patients as a peer educator	I'm satisfied with my role in helping patients with the same disease (i.e., diabetes) by sharing my knowledge and experiences through my activities as a peer educator.
		As a peer educator, I'm satisfied with the fact that I'm able to help other patients.
Increased motivation to continue the activities as a peer educator	Awareness of the peer-educator's responsibility in working as a peer educator	We will continue to educate people in the community.
		I would like to continue the activities assigned to peer educators.
		I don't expect anything in return from the peer-led education activities, apart from serving the patients as much as possible, but I do not regret it.
		Because I'm a volunteer, I have to do my best to fulfill my duties and responsibilities.
	Peer-educator's active encouragement of patients to participate in DSME sessions	Although I sometimes get confused and forgetful because I'm aging, as a peer educator I'm trying as hard as possible to tackle these issues.
		There is a need to encourage patients to participate in peer-educator activities for the patients' own improvement and growth.
		I encourage busy patients to attend the peer-educator activities that suit their schedules.

Table 2. *Continued*

Category	Code	Peer-educator's excerpted expression
Active collaboration among peer educators	Peer-educator engagement in education of patients to the greatest extent possible	We, as peer educators, review what we have discussed so far.
	Peer-educator's preparedness to work together with other peer educators to educate patients	I collaborate with other peer educators to make our activities more interesting so that the patients want to keep attending our activities.
		We collaborate with each other at our regular meetings.
		We share what we have learned.
Difficulties and concerns in working as a peer educator	Difficulties in encouraging patients to participate in activities offered by the peer educator because various circumstances hinder their attendance (i.e., participation)	As a peer educator, I've not been able totally to fulfill my responsibility regarding the behaviors the patients are expected to complied with.
		I realize the difficulty of educating patients who are unable to attend peer-educator activities; maybe these patients will have to take matters into their own hands.
		Sometimes patients couldn't attend the activities because of their own problems.
		It's also a problem that the patients' participation (i.e., engagement) in activities varies so much.
		As time passed, it sometimes became difficult to get enough patients to attend the activities.
		Patients sometimes fail to attend an activity on the scheduled day at the scheduled time.
	Economic difficulties in implementing regular checkups of diabetes-related indicators in patients	I feel that it may be financially difficult to regularly check the patients' diabetes-related indicators.
		I'd like to increase the opportunities for patients to receive medical checkups as cheaply as possible, and to enhance the workforce needed to perform these checkups.
	Concerns about continuing activities as a peer educator because of deterioration of the peer-educator's own physical condition	Because of my age (i.e., getting older), it's getting harder physically and mentally to perform my activities as a peer educator.
		Sometimes I don't feel well. The peer-educators' health is not always good.
		I'm concerned about my unstable diabetes indicators.
		We have problems, such as our aging and poor health, in continuing our activities as peer educators.
	Lack of confidence in guiding patients as a peer educator	I lacked experience in teaching patients with confidence.
		When I was appointed as a peer educator, I couldn't sleep well because I was worried about how I would be able to lead and educate the patients.
		I'm concerned about not knowing how to educate the patients effectively.
Need for continuous intellectual, technical, and material support regarding diabetes	Peer-educators need medical services for their own and other patients' diabetes	I need you to give us information on the methods of diabetes self-management that you are familiar with.
		It would be better if we had more ophthalmologists.
		I'd like you to provide more training for us.
	Peer-educators need continuous technical support for their education activities	I want to know what you can teach us.
		I hope that some organizations will support patients according to their needs in the future.
		I need your continuous support and help in future years.
	Peer-educators need in-kind support for dealing with other patients' diabetes, as well as their own	I need your support for diabetic medication for our day-to-day health maintenance.
		We would like you to continue to provide the consumables required for checking the patients' diabetes-related indicators.

model was not explicitly expected when we organized the training. Therefore, we considered the training offered to the participants to have functioned well to prepare them for their activities as peer educators.

The third category of {Lack of a sense of risk from the diabetes because of inadequacy of the peer-educator's basic knowledge of the disease} implies that the peer educators did not perceive the risks associated with their diabetes and its related complications. Kelly *et al.*[22] reported that patients perceive severity according to the five stages of the Transtheoretical Model (TTM) of behavioral change,[23] and that their perception

of severity was lowest at the pre-contemplation and contemplation stages than at the other three stages. Before starting their peer-education activities, the peer educators in our study appeared to be at the pre-contemplation or contemplation stage. According to the TTM, patients in these two stages are less active in the practice of healthy behavior compared with patients in the other stages. In the Health Belief Model, a lack of patients' healthy behavior is attributed to their insufficient perception of the severity of, or their susceptibility to, the disease and its complications, and of the threat to their prognosis.[23] In the current study, we confirmed that the peer educators, before starting peer education, had not reached the stage at which they actively practiced healthy behaviors. Such inactiveness may imply that we did not sufficiently convey the risks posed by diabetes and its complications to the peer educators during the training course. This was partly due to the short length of the training course, which limited the amount of information that could be presented. A previous study reported a positive correlation between the dengue fever threat perceived by people in Pakistan and their preventive practices against infection; this suggests that the dengue fever information disseminated to people should emphasize the threat.[24] Likewise, an intervention that promotes awareness of the threat of diabetes might be recommended for diabetes patients.

The category of {Cognition of the effects of learning about diabetes self-management} indicated that the peer educators realized the need to take actions to tackle their disease. The fourth category of {Need for external support to continue diabetes-related activities} may have appeared from this realized cognition of the peer educators. The codes of <Continuous support for the peer-educators' activities is needed>, <I hope somebody will give us support related to diabetes>, and <We need your help in providing medical help> indicated the peer-educators' need for external support. Medical resources in the study municipality are limited; this municipality is one of the smallest in Metro Manila in terms of total population, and it suffers from low levels of funding for medical services.[13] The peer educators' needs for external support may have stemmed from their recognition of their own need to take effective, practical actions for the treatment of their own disease. Furthermore, <There is a need to continue medical checkups> and <I hope another seminar will be held to support patients with diabetes and improve their knowledge> implicitly suggested their desire to be of help to other patients.

The four categories indicated in our pre-education results were compared with those extracted in the post-education results (i.e., the second interview). In the second interview, we found categories suggesting changes of the peer-educators' cognition and emotions that were not indicated previously. After starting their peer-education activities, the peer educators gradually arrived at {Cognition of patients' active learning attitudes and of positive changes in patients' physical conditions and behavior} (Table 2) through their continuous support of the patients. The peer-educators' cognition of the patients' positive changes in response to the education program indicated that the peer educators had accomplished their roles as peer educators or achieved the goals that had been set by themselves or were expected by others. A previous report mentioned "achievement experience" as a factor that increases one's self-efficacy (self-confidence).[18] The code of [Acquisition of confidence in educating patients as a peer educator] may have materialized from the peer-educators' cognition of the accomplishment of their role and goals.

A study of the growth stages of peer supporters of undergraduates reported that the following emotions occurred in the initial stage of their growth as peer supporters: "I try anyway, even if I'm not confident," "I won't quit as a peer supporter," and "I won't give up my role as a peer supporter."[25] The excerpted expressions and codes of the peer educators in our study, which included <I would like to continue the activities assigned to peer educators>, <I don't expect anything in return from the peer-led education activities, apart from serving the patients as much as possible>, <Because I'm a volunteer, I have to do my best to fulfill my duties and responsibilities>, and [Awareness of the peer-educator's responsibility in working as a peer educator], indicated that the peer educators recognized that they had to continue their activities as peer educators. We can further surmise that the appointment of the peer educators functioned as an "externally regulated extrinsic motivation"[26, 27] to promote their continuation of their activities as peer educators.

The peer-educators' cognition of the changes induced in their patients was expressed as {Cognition of growth as a peer educator} and {Satisfaction with supporting patients as a peer educator}. Their cognition, as expressed by these categories together with the code of [Acquisition of confidence in educating patients as a peer educator], was likely an intrinsic motivator for them to continue their activities. This intrinsic motivation, which is acquired by fulfilling all of one's needs for acceptance from others, for self-determination, and for competence, encourages autonomous behavior.[26, 28, 29] Here, we found that the need for acceptance from others was fulfilled by the peer-educators' feeling {Satisfaction with supporting patients as a peer educator}. The need

for self-determination was fulfilled through consciousness of their own health problems, discussions of their own problems initiated by themselves, and their behaviors based on the discussions. However, the need for competence was not completely fulfilled, as demonstrated by {Difficulties and concerns in working as a peer educator}, although these difficulties did appear to be "desirable difficulties" (difficulties that encourage one to continue efforts to surmount them) that can be converted into motivation to overcome challenges.[30] Accomplishment of one's role contributes to fulfillment of one's need for competence.[29] To help the peer educators overcome the challenges and accomplish their roles, in the follow-up guidance we offered the peer educators booklets that could be used for dietary guidance of patients These mostly fulfilled needs gave the peer educators intrinsic motivation to continue their activities as peer educators (i.e., {Increased motivation to continue the activities as a peer educator}). A positive correlation between the motivation levels of Chinese medical students and their self-efficacy levels has been reported.[31] Similarly, the peer-educators' increased intrinsic motivation in our study may have led to positive changes in their self-efficacy (i.e., in their confidence in their activities).

Contrary to the peer-educators' positive changes, which contributed to their extrinsic and intrinsic motivation, and self-efficacy in education for patients, we also found {Difficulties and concerns in working as a peer educator}, which included [Difficulties in encouraging patients to participate in activities offered by the peer educator ...] and [Lack of confidence in guiding patients as a peer educator]. Before receiving the training, the peer educators did not have enough knowledge to guide the patients, nor did they have experience as educators; therefore, they were unable to predict the potential difficulties they might face in their peer-education activities. The excerpted expression <Patients sometimes fail to attend an activity on the scheduled day at the scheduled time> suggested that the peer-educators' guidance did not suit the patients. However, these difficulties may also have functioned as desirable difficulties. The regular monitoring reports from the physician in the diabetes clinic on the peer-educators' activities appeared to support the concept that the difficulties they felt could be considered desirable ones, as supported by comments such as "Because I'm already 79 years old, there were times when confusion and forgetfulness occurred. But I still try my best to perform my assignment as a peer educator." and "As peer educators, we should encourage the patients to join our group activity for their improvement"; although it should be noted that the results from these reports did not completely reflect those from our two interviews.

These desirable difficulties increased the peer-educators' efforts and intrinsic motivation to tackle the difficulties they encountered, promoted their learning about diabetes self-management, and then enhanced their perceived severity of the prognosis of their own disease. Kelly *et al*. indicated a positive association between perceived disease severity and healthy behaviors.[22] In our post-education activities results (i.e., the second interview), no categories regarding {Lack of a sense of risk from the diabetes ...} were found, indicating that the peer-educators' post-education sense of threat had increased. This increased awareness was implicitly suggested by <The patients' awareness of the benefits of diabetes self-management increased through the peer-educators' continuous efforts to remind patients of the threat of diabetes.> In the Health Belief Model, patients' healthy behaviors are promoted by their perception of the threat of the seriousness of a disease and its complications. Therefore, at post-education, the peer educators in this study may have been more conscious of healthy behaviors than at pre-education. According to the TTM, the peer educators undertaking these healthy behaviors are at the action or maintenance stages.[23] One's observation of another's success can be a source of information for forming one's self-efficacy for behavioral change (i.e., vicarious experience).[32] Likewise, the transition of the peer-educators from the pre-contemplation or contemplation TTM stages to the action or maintenance stages would arouse behavioral changes in the patients they educate as those patients observe the peer-educators' transitions.

The desirable difficulties experienced by the peer educators may have promoted their collaboration to rapidly achieve their goals. Nishimura and Ito reported three cases in which elementary-school teachers of home economics overcame the difficulties they faced through consultation and discussion with their colleagues.[33] These consultations and discussions can be regarded as the initial actions of their collaborative work with others. Likewise, the difficulties experienced by the peer educators as demonstrated by [Difficulties in encouraging patients to participate in activities offered by the peer educator ...] encouraged them to consult with the other peer educators. This encouragement was supported by the code of <I collaborate with other peer educators to make our activities more interesting...>. The initial action taken by a member of a group leads to collaboration among the members when their interdependence increases through the gradual resolution of concerns about the members' relationships with

others.[34] These concerns include the need for reciprocal acceptance of oneself and others, the need to freely speak about one's thoughts and feelings, and the need to form one's own, personal goals. Concerns over the need to "form goals" can be resolved by forming one's own goals by oneself.[35] Here, as we suggested in the follow-up guidance, the realization that there were health issues common to the diabetes patients in the municipality appeared to promote resolution of the peer-educators' concerns regarding "acceptance" and "speaking freely." Moreover, discussion among the peer educators regarding these suggested issues was initiated by the peer educators themselves. Our approach to encouraging the peer-educators' initiative helped them to "form their own goals." Ultimately, the intervention in our follow-up guidance helped to resolve their concerns regarding enhancement of their interdependence. Enhancement of the interdependence of members of a group helps to increase both their collaborative behavior and their consciousness of the importance of collaborative work.[35] In our study, the peer-educators' consciousness of collaborative work was established on the basis of their interdependence, and their actual collaborative work, as demonstrated by {Active collaboration among peer educators}, may have contributed to their managing more of the desirable difficulties that they faced afterward. Furthermore, collaborative work positively affects the motivation of volunteers such as peer educators to continue their activities.[36] Therefore, it is plausible that the observed collaborative work among the peer educators helped to increase the sustainability of the peer-led education program.

The peer-educators' cognition of positive changes in the patients and of desirable difficulties through their education activities led to their cognition of the {Need for continuous intellectual, technical, and material support regarding diabetes} to continue their activities in the urban poor area of the Philippines. Here, we found that the implicit desires expressed by the peer-educators for the patients in the first interview became materialized through their education activities. However, any support given in response to this cognition should not inhibit the peer-educators' "need for autonomy,"[26] which is a promoter of intrinsic motivation.[37] We expected that the support that we gave in the 7 months after the start of the education activities would maintain the peer-educators' intrinsic motivation. They were provided with opportunities to regularly check their own health status, whereas the patients living in the municipality had less access to medications and blood tests for diabetes. It is important for patients to maintain contact with other patients and health professionals.[3, 38] Giving patients opportunities to face themselves and reconsider their behavior to institute proper self-management is one of the measures likely to enhance DSME. Awareness of this importance among peer educators (i.e., of the need for patients to have regular contact with medical services), as demonstrated by {Need for continuous intellectual, technical, and material support regarding diabetes} (Table 2) as well as by [Peer-educators need the external support for the other patients] (Table 1) and <I hope another seminar will be held to support patients with diabetes>, may also indicate their motivation to continue their activities as peer educators.

Here, we analyzed the changes in peer-educators' cognition and emotions between two time points: before and after 7 months of peer-education activities. Their post-education-activities cognition of the patients' positive changes and of their own achievements as peer educators and the goals set by themselves increased their self-confidence in educating patients. This cognition also induced their satisfaction with supporting patients and their cognition of growth as peer educators. These two feelings, together with the extrinsic motivation offered by their appointment as peer educators, enhanced their intrinsic motivation to continue their activities as peer educators. The difficulties they faced through their education activities, considered here to be desirable difficulties, increased their learning about diabetes and the perceived severity of their disease, which in turn contributed to positive behavioral changes in both the peer educators and the patients. Moreover, these difficulties appeared to encourage the peer-educators' collaboration to overcome other difficulties, and they helped to increase the sustainability of the diabetic peer-led education program. To sustain the program for a long time, we suggest the need for an intervention that 1) increases the peer-educators' motivation toward their activities and 2) stimulates their consciousness of the importance of collaborating with each other. To our knowledge, the need to promote such consciousness to enhance the sustainability of a peer-led DSME program has not previously been reported. This consciousness is subjective and dynamic for each subject and is dependent on one's own interpersonal relationships; therefore, information about it would not have been obtained through a quantitative study.[6] The importance of qualitative study, which aims to deepen the understanding of our emotions and consciousness, is thus emphasized.

A limitation of this study was the inclusion of only a small number of subjects (i.e., interviewees) from a single community, which limits the generalizability of the results. Another limitation was that we could not directly ask the peer educators about the cause of their

emotional changes during their peer-education activities; we had to discuss the cause with the support of published materials. Furthermore, because the number of hours of DSME offered by the peer educators to each patient was not counted, we cannot discuss the effects of their experience as peer educators on their cognitive changes. Further studies with improved methods are needed.

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